1. Consider an LTI system with frequency resp

$$H(e^{j\omega}) = e^{-j(2\omega-\pi/4)}\left(\frac{1+e^{-j}}{1+(}\right.$$

Determine $y[n]$, the output of this system, f

$$x[n] = \cos\left(\frac{9\pi n}{4}\right)$$

for all n. Your answer should contain a cos function.

$\frac{\pi}{4}$ = down to $\frac{\pi}{4}$ and $-\frac{\pi}{4}$

$$\cos\left(\frac{9\pi n}{4}\right) = \frac{e^{j\frac{9\pi n}{4}} + e^{-j\frac{9\pi n}{4}}}{2}$$

$$H(e^{j\frac{\pi}{4}}) = e^{-j(2(\frac{\pi}{4})-\pi/4)}\left(\frac{1+e^{-j4(\frac{\pi}{4})}+4e^{-j8(\frac{\pi}{4})}}{1+0.5e^{-j4(\frac{\pi}{4})}}\right)$$

$$= e^{-j\pi/4}\left(\frac{1+e^{-j\pi}+4e^{-j2\pi}}{1+0.5e^{-j\pi}}\right) = e^{-j\frac{\pi}{4}}\left(\frac{1+-1+4}{1-0.5}\right)$$

$$= e^{-j\pi/4}\left(\frac{4}{1/2}\right) = 8e^{-j\pi/4}$$

$$H(e^{-j\pi/4}) = e^{-j(2(-\pi/4)-\pi/4)}\left(\frac{1+e^{-j4(-\pi/4)}+4e^{-j8(-\pi/4)}}{1+0.5e^{-j4(-\pi/4)}}\right)$$

$$= e^{+j3\pi/4}\left(\frac{1+-1+4}{1-0.5}\right) = 8e^{+j3\pi/4}$$

$$y[n] = \frac{8\left(e^{-j\pi/4}e^{j9\pi/4 n} + e^{j3\pi/4}e^{-j9\pi/4 n}\right)}{2}$$

$$= \frac{8\left(e^{-j\pi/4}e^{j\pi/2}e^{j\pi/4 n} + e^{-j\pi/2}e^{j\pi/4}e^{-j\pi/4 n}\right)}{2}$$

$$\boxed{y[n] = 8e^{+j\pi/4}\cos\left(\frac{9\pi}{4}n - \frac{\pi}{2}\right)}$$